

KOLKATA METRO RAIL CORPORATION LIMITED

**EAST WEST CORRIDOR PROJECT
SAFETY HEALTH AND ENVIRONMENTAL
MANUAL**

PART - 2

Policy and Procedures

Part 2 – Environmental and Health

(August 2009)

STATEMENT OF INTENT

The Kolkata Metro Rail Corporation firmly believes in a “development which meets the needs of the present without compromising the ability of future generations to meet their own needs”. This commitment towards sustainable development is manifested clearly in our corporate culture, even as we continue to build a world-class metro.

It is the intent of KMRC to demonstrate continual improvement in its environmental management system during construction of the underground phase of the East West Corridor.

This manual represents the minimum standards that the Kolkata Metro Rail Corporation will accept on matters of Environment. It lays down the guidance for environmental protection measures to be adopted as part of mitigation strategy for overcoming adverse environmental impacts during construction. It suggests environmental friendly construction practices that the contractors are encouraged to adopt in order to contain various types of pollutants and impacts that may be generated due to construction activities.

The Kolkata Metro Rail Corporation actively supports the efforts and initiatives that are instigated by the Contractors and sub-contractors in their efforts for achieving good standards of Environment on the project. The Corporation will use its best endeavors to ensure that all of the Contractors employed on the Project achieve these Standards.

(Sumantra Choudhury)
Managing Director/KMRC

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ENVIRONMENTAL MANAGEMENT MANUAL (Refer Employer's Requirements on Environment)

1.0 INTRODUCTION

- 1.1 This Environmental Management Manual (EMM) forms an essential part of the overall Environmental protection system employed by KMRC for the construction of Kolkata East West Corridor project.
- 1.2 This manual has been prepared to facilitate construction progress while ensuring fulfillment of environmental commitments. It provides systematic procedures for monitoring and minimizing environmental impacts that may arise from the construction activities.
- 1.3 This manual will apply to all construction works by the Kolkata Metro Rail Corporation for surface, elevated and underground corridors carried out by the Contractors and Sub-contractors.
- 1.4 The primary reason for adopting the Manual approach is to make the Contractor aware of his environmental responsibilities and to ensure his commitment to achieving the specified standards.
- 1.5 The KMRC Environmental Manual is meant to be a living document that will be updated as design and construction progresses and when further environmental issues are identified.
- 1.6 Periodic reviews of the plan and procedures will be performed to ensure continual improvement of the Plan's adequacy and it will be expanded and updated during the project duration.
- 1.7 Because the work potentially involves design-bid-build and design/build contracts, this Manual is intended to be flexible and tailored to match highly variable construction activities and locations throughout the project.
- 1.8 This manual is set out as follows:
 - ◆ Section 2 highlights the purpose and scope of this Manual
 - ◆ Section 3 outlines the objectives of the manual which will form a basis for Environmental Management System
 - ◆ Section 4 lists the definitions and abbreviation of terms used in the manual
 - ◆ Section 5 sets out the responsibilities for application of the procedures
 - ◆ Section 6 provides guidance to the Contractor for preparation of his contract specific Site Environmental Plan
 - ◆ Section 7 commits the Contractor's Method Statement to incorporate Environmental issues during execution of works
 - ◆ Section 8 focuses on the Environmental Performance Review of Contractor's activities through Environmental Audits
 - ◆ Section 9 details measures to contain Air, Water, and Noise Pollution and management of Waste through Environmental Friendly Construction Practices
 - ◆ Section 10 specifies good Housekeeping measures
 - ◆ Section 11 is on Landscape and Aesthetics
 - ◆ Section 12 suggests measures to conserve energy through effective Energy Management
 - ◆ Section 13 deals with Traffic Management
 - ◆ Section 14 focuses on requirements that the Contractor shall have to meet in case Archaeological and Historic Resources are encountered

- ◆ Section 15 on Environmental Monitoring lists the relevant monitoring equipment, compliance criteria and monitoring programme to be undertaken by the Contractor during construction
- ◆ Section 16 details requirements for impact monitoring for air quality including Air Monitoring and Control Plan
- ◆ Section 17 details requirements for impact monitoring for noise including Noise Monitoring and Control Plan
- ◆ Section 18 describes the Environmental Site Inspection process to be implemented by the Contractor
- ◆ Section 19 details the Environmental Audits which the employer may under take as part of environmental performance review
- ◆ Section 20 details the Reporting requirement as related to submission of Contractor's Monthly Environmental Management Report under this manual
- ◆ Section 21 sets out the Complaint response process and finally,
- ◆ Section 22 mentions the requirements of Completion of the EMM programme

2.0 PURPOSE & SCOPE

- 2.1 The purpose of this Environmental Management Manual (EMM) is to make the Contractors aware of the environmental concerns of KMRC, and to establish guidelines for the application of environmental controls during the construction of the current phase of the project.
- 2.2 This manual is intended to translate into practice, three important principles of KMRC 's mandate – that construction activities should not:
- ◆ Inconvenience or endanger public
 - ◆ Create a permanent visual eyesore
 - ◆ Result in unmitigated ecological or environmental degradation
- 2.3 This manual is intended to guide and assist the Contractors in exploring all reasonable and feasible means for reducing construction related environmental impacts as they prepare and produce contract-specific Site Environmental Plans as required by the Contract.
- 2.4 This manual stipulates environmental controls that, in lieu of alternative controls specified by the contractor, must be applied.
- 2.5 Environmental controls adopted by the individual contractors as an alternative to the measures identified herein must be as protective of the environment.
- 2.6 The scope of this manual is to establish procedures to :
- ◆ Supervise Contractor's compliance with defined environmental control criteria by carrying out reviews of monitored impact data
 - ◆ Oversee the procedure for identification of mitigation measures, their design and implementation
 - ◆ Carry out environmental monitoring emissions during construction through an impact monitoring programme
 - ◆ Undertake additional ad hoc monitoring if required to address specific instances

3.0 OBJECTIVE

- 3.1 The various components included in this manual along with the Employer's requirement on Environment will form the basis of an Environmental Management System to be implemented

by KMRC, which will enable it to manage the environmental challenges and resolve environmental issues posed during construction of East West Corridor Project, Kolkata.

3.2 The main objectives are to:

- ◆ Provide database from which environmental impacts of the project can be determined.
- ◆ Provide timely indication if any environmental control measure fails to achieve desired results.
- ◆ Monitor effectiveness of environmental mitigation measures
- ◆ Initiate remedial action if unacceptable impacts arise.
- ◆ Determine contractor's compliance with statutory and legal requirements.

4.0 DEFINITION & ABBREVIATIONS

4.1 **Air Monitoring and Control Plan** is abbreviated as AMCP.

4.2 **Auditor:** Person with the competence to conduct an audit.

4.3 **A – weighted** Noise levels in Decibels (referenced to 20 micro-Pascal) as measured with A-weighting network of standard sound level meter, abbreviated dB (A).

4.4 **Continual improvement:** Recurring process or enhancing the environmental management system in order to achieve improvements in overall environmental performance consistent with the organization's environmental policy.

4.5 **Corrective action:** Action to eliminate the cause of a detected nonconformity.

4.6 **Decibel** is measure on a logarithmic scale of the magnitude of a particular quantity (such as sound pressure, sound power) with respect to a standardized reference quantity.

4.7 **Document:** Information and its supporting medium.

4.8 **Energy Equivalent Level (L_{eq})** is the level of a steady noise which has the same energy as the fluctuating noise level integrated over the period of measurement. L_{max} is the maximum Noise Level during the period of measurement. L_{10} and L_{90} are the are the percentile exceeding levels of sound which are exceeded 10% and 90% of the time of measurement.

4.9 **Environmental Pollutant** means any solid, liquid or gaseous substance present in such concentration as may be or tend to be injurious to environment.

4.10 **Environmental Pollution** means the presence in the environment of any environmental pollutant.

4.11 **Environment:** Surroundings in which an organization operates, including air, water, land, natural resources, flora, fauna, humans, and their interrelation.

4.12 **Environmental Aspect:** Element of an organization's activities or products or services that can interact with the environment.

4.13 **Environmental Impact:** Any change to the environment whether adverse or beneficial, wholly or partially resulting from an organization's environmental aspects.

4.14 **Environmental Management Manual** is abbreviated as EMM.

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- 4.15 **Environmental Management System:** Part of an organization's management system used to develop and implement its environmental policy and manage its environmental aspects.
- 4.16 **Environmental Objective:** Overall environmental goal, consistent with the environmental policy that an organization sets itself to achieve.
- 4.17 **Environmental Performance:** Measurable results of an organization's management of its environment aspects.
- 4.18 **Environmental Policy:** Overall intentions and direction of an organization related to its environmental performance as formally expressed by top management, under signature.
- 4.19 **Environmental Target:** Detailed performance requirement applicable to the organization or parts thereof, that arises from the environmental objectives and that needs to be set and met in order to achieve those objectives.
- 4.20 **Interested Party:** Person or group concerned with or affected by the environmental performance of an organization.
- 4.21 **Internal audit:** Systematic, independent and documented process for obtaining audit evaluating it objectively to determine the extent to which the environmental management system audit criteria set by the organization are fulfilled.
- 4.22 **Ministry of Environment and Forest,** Government of India is abbreviated as MOEF.
- 4.23 **Monitoring** is the use of direct or indirect reading field instrumentation to provide information regarding the levels of pollutants released during construction.
- 4.24 **Noise** is any unwanted sound disturbance of the environment around the area of construction operations.
- 4.25 **Noise Monitoring and Control Plan** is abbreviated as NMCP.
- 4.26 **Nonconformity:** Non-fulfillment of a requirement.
- 4.27 **Nuisance** is annoyance, which results from any construction activity that affects the material comfort and quality of life of the inhabitants of the area surrounding the construction site.
- 4.28 **Organization:** Company, corporation, firm, enterprise, authority or institution, or part or combination thereof, whether incorporated or not, public or private, that has its own functions and administration. It also includes the contractor executing the KMRC contract for East West Corridor Project, Kolkata.
- 4.29 **Preventive Action:** Action to eliminate the cause of a potential nonconformity.
- 4.30 **Prevention of pollution:** Use processes, practices, techniques, materials, products, services or energy to avoid, reduce or control the creation, emission or discharge of any type of pollutant or waste, in order to reduce adverse environmental impacts.
- 4.31 **Procedure:** Specified way to carry out an activity or a process.
- 4.32 **Record:** Document stating results achieved or providing evidence of activities performed.
- 4.33 **Respirable Particulate Matter** is abbreviated as RPM and is particulate matter with size less than 10 μm and is measured in $\mu\text{g}/\text{m}^3$ (microgram per cubic meter)

- 4.34 **Suspended Particulate Matter** is abbreviated as SPM and measured in $\mu\text{g}/\text{m}^3$ (microgram per cubic meter)
- 4.35 **Site Environmental Plan:** A document prepared by the contractor that contains detailed procedures on implementing the Employer's requirement on Environment.
- 4.36 **Usage factor:** Expressed as the percent of time that the equipment is operated at full power while on site.
- 4.37 **Waste** is unwanted surplus substance arising from the application of all construction operations and any substance or articles, which is required to be disposed.
- 4.38 **West Bengal Pollution Control Board (WBPCB).**

5.0 RESPONSIBILITIES

- 5.1 The contractor shall set up an environmental team to execute the environmental requirements.
- 5.2 The duties of the Contractor's Environmental Team will include (but not limited to):
- To monitor the various environmental parameters as required by the Manual
 - To inspect, investigate and audit the work methodology with respect to environmental mitigation and control
 - To anticipate environmental issues before they arise and plan for their mitigation
 - To audit and prepare audit reports, weekly/monthly reports on site environmental conditions for submission to the employer
- 5.3 Reporting to the Employer, the Contractor shall:
- Work within the scope of contract and other tender condition.
 - Operate and strictly adhere to the requirements of his contract specific-SEP
 - Undertake any corrective actions as instructed by his Environmental Manager
- 5.4 To lead his Environmental team, the Contractor shall deploy an Environment Manager who shall be responsible for environmental control, pollution monitoring, and record keeping and be available to the Employer for resolution of environmental issues.

6.0 SITE ENVIRONMENTAL PLAN

- 6.1 To effectively implement monitoring, mitigation and remedial requirements, an appropriate contractual and supervisory framework needs to be established.
- 6.2 The basis of framework within which implementation will be managed is through the preparation of contract-specific Site Environmental Plan by the Contractor. The Employer will audit this contract-specific plan and advise the necessary remedial actions required through contractual means.
- 6.3 The Site Environmental Plan shall provide details of the means by which the Contractor (and all subcontractors working for the Contractor) will implement the recommended mitigation measures and achieve the environmental performance standards defined both in Indian environmental legislation and in the Employer's Requirements.
- 6.4 Based on Environmental Management Plan outline given in this document, as Appendix – I each Tenderer shall prepare an outline Environmental Plan for submission as part of the tender process.

6.5 The outline Environmental Plan shall demonstrate the determination and commitment of Contractor's organisation towards environment and indicate how the environmental performance requirements laid out in the Employer's requirements will be met and, where appropriate exceeded.

6.6 Within two months of the date of Notice to Proceed, Contractor shall submit a draft contract – specific Site Environmental Plan for the approval of the Employer and a final version prior to the commencement of the works. (Refer clause 12 (a) of Employer's Requirement on Environment).

6.7 The contract-specific Site Environmental Plan will contain description of all procedures developed to meet the requirement defined in sections 2.0, 3.0 and 7.0 of this document, to control environmental pollution. Elements of the plan must address the management of pollution, the monitoring programme, and the reporting requirements.

7.0 CONTRACTOR'S METHOD STATEMENT

7.1 It is common practice for the Contractor to prepare method Statement in advancement of actual works, for the approval of the Employer.

7.2 The Contractor's Environmental Manager will be one of the signatories to the Method Statement, after assessing and verifying the environmental impact of the prepared construction activity and ensuring that effective control measures will be in place, timely.

8.0 ENVIRONMENTAL PERFORMANCE REVIEWS

8.1 Environmental Performance Reviews, through an Environmental Audit Programme, may be carried out quarterly by the employer to assess the effectiveness of the Site Environmental Plan, and that the required mitigation measures are routinely implemented and environmental standards are maintained.

8.2 The preliminary objective of the audit programme will be to assess the effectiveness of management systems established by the Contractor to implement the environmental mitigation measures.

8.3 The reviews by Employer shall focus on the effectiveness of the implemented measures to achieve the purpose not simply the fact that a measure has been implemented.

8.4 In such reviews, demonstrable evidence on the part of the environmental requirements will be sought.

8.5 The Contractor shall carry out daily, environment inspection of his works and submit a weekly report as per format for reporting is suggested as Appendix – II.

8.6 The Contractor shall ensure that his weekly/monthly environmental reports and mandating audits are linked to respective previous submission. The Employer will ensure that this procedure is followed by the institution of a monitoring and reporting system that provides information about the environmental performance of the construction contractor throughout the duration of the contract.

8.7 The Employer will monitor Contractor's performance of tasks specified, and will inspect necessary records, reports and procedures as defined in this manual. Environmental Performance Reviews, through an Environmental Audit Programme, may be carried out quarterly by the employer to assess the effectiveness of the Site Environmental Plan, and

- that the required mitigation measures are routinely implemented and environmental standards are maintained.
- 8.8 The preliminary objective of the audit programme will be to assess the effectiveness of management systems established by the Contractor to implement the environmental mitigation measures.
- 8.9 The reviews by Employer shall focus on the effectiveness of the implemented measures to achieve the purpose not simply the fact that a measure has been implemented.
- 8.10 The Employer will monitor Contractor's performance of tasks specified, and will inspect necessary records, reports and procedures as defined in this manual. Environmental Performance Reviews, through an Environmental Audit Programme, may be carried out quarterly by the employer to assess the effectiveness of the Site Environmental Plan, and that the required mitigation measures are routinely implemented and environmental standards are maintained.
- 8.11 The preliminary objective of the audit programme will be to assess the effectiveness of management systems established by the Contractor to implement the environmental mitigation measures.
- 8.12 The reviews by Employer shall focus on the effectiveness of the implemented measures to achieve the purpose not simply the fact that a measure has been implemented.
- 8.13 In such reviews, demonstrable evidence on the part of the environmental requirements will be sought.
- 8.14 The Contractor shall carry out daily, environment inspection of his works and submit a weekly report as per format for reporting is suggested as Appendix – II.
- 8.15 The Contractor shall ensure that his weekly/monthly environmental reports and mandating audits are linked to respective previous submission. The Employer will ensure that this procedure is followed by the institution of a monitoring and reporting system that provides information about the environmental performance of the construction contractor throughout the duration of the contract.
- 8.16 The Employer will monitor Contractor's performance of tasks specified, and will inspect necessary records, reports and procedures as defined in this manual.

9.0 ENVIRONMENTAL FRIENDLY CONSTRUCTION PRACTICES

9.1 Containment of Air Pollution

9.1.1 During Transport of Material

- (a) The Contractor shall take precautions to minimise visible particulate matter from being deposited upon public roadways as a direct result of his operations. Precautions include removal of particulate matter from equipment before movement to paved streets or prompt removal of material from paved streets onto which such material has been dropped.
- (b) All construction equipment should be washed clean of visible dirt/mud before exiting the construction sites. Any deposition of material on public streets by construction equipment should be removed by manual sweeping, or by deploying electro – mechanical devices.
- (c) The Contractor shall provide a wash pit or a wheel washing and/or vehicle cleaning facility at the exits from work sites such as construction depots and batching plants. At such facility, high-pressure water jets will be directed at the wheels of vehicles to remove all spoil and dirt.

Water shall be pumped through an electrically operated pump set, to hydrants attached with rubber hoses, by activation of push button located at the hydrant, allowing for up to 10 minutes of wash time.

- (d) Wheel washing facilities will be provided with efficient drainage, incorporating silt traps to prevent any excessive build up of water. These facilities could include water re-circulation apparatus to minimise water consumption. At the wheel wash facility, water, dirt, gravel etc. shall be drained into precast trench drains with removable grated cover. This dirty water shall flow, through a piping, into solids separator and from there to oil separator before final discharge.
- (e) Where wheel-washing facility is not possible, the contractor shall ensure manual cleaning of wheels by wire brushes or similar suitable means.
- (f) The Contractor shall ensure that vehicles with an open load carrying area used for moving potentially dust-producing materials shall have properly fitting side and tailboards. Materials having the potential to create dust shall not be loaded to a level higher than the side and tail boards, and shall be carried in vehicles fitted with covers.

9.1.2 At Dumping Sites

- (a) The Contractor shall place excavated materials in the dumping/disposal areas designated in the drawings.
- (b) The Contractor shall place material in a manner that will minimise dust production. Material shall be stabilised each day by watering or other accepted dust suppression techniques.
- (c) The heights from which materials are dropped shall be the minimum practical height to limit fugitive dust generation.
- (d) The Contractor shall stockpile material in the designated locations by the Employer with suitable slopes. Access to the site shall be regulated for entry of men, material and machine.
- (e) During dry weather, dust control methods such as water sprinkling must be used daily especially on windy, dry day to prevent any dust from blowing. During rains, the stockpile may be covered with tarpaulin or similar material to prevent run off.
- (f) The Contractor shall provide water sprinkling at any time that it is required for dust control use.
- (g) Sufficient equipment, water, and personnel shall be available on dumping sites at all time to minimise dust formation and movements to prevent nuisance.
- (h) Dust control activities shall continue even during work stoppages.

9.1.3 At Construction Site

- (a) At each construction site, the Contractor shall provide storage facilities for dust generating materials and shall be closed containers/bins or wind protected shelters or mat covering or walled or any combination of the above to the satisfaction of the Employer. The Contractor shall spray water at construction sites as required to suppress dust, during handling of excavation soil or debris or during demolition.

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- (b) Stockpiles of sand and aggregate greater than 20m³ for use in concrete manufacture shall be enclosed on three sides, with walls extending above the stockpile and two (2) metres beyond the front of the stockpile.
 - (c) Effective water sprays shall be used during the delivery and handling of all raw sand and aggregate and other similar materials, when dust is likely to be created and to dampen all stored materials during dry and windy weather.
 - (d) Areas within the Site such as construction depots and batching plants, where there is a regular movement of vehicles shall have an approved hard surface that is kept clear of loose surface material.
 - (e) Unless the Employer has given consent otherwise, the Contractor shall restrict all motorised vehicles on the Site to a maximum speed of 15 kilometers per hour and confine haulage and delivery vehicles to the designated roadways inside the site.
 - (f) At the Batching plant the following additional conditions shall be complied with:
 - ◆ The Contractor shall undertake at all times the prevention of dust nuisance as a result of his activities.
 - ◆ The Contractor shall frequently clean and water the concrete batching plant and crushing plant sites and ancillary areas to minimise any dust emission.
 - (g) The Contractor shall erect hoardings as specified in Employer's Requirements – Construction, securely around all construction work sites during the main construction activity, to contain dust within the site area and also to reduce air turbulence caused by passing traffic. The hoarding shall be safely secured to the ground to prevent from toppling with minimum gap between the base of hoarding and ground surface.

9.1.4 During Drilling and Blasting

- (a) Water spray should be used to control dust during breaking of rock/concrete.
- (b) During blasting operations, appropriate precautions should be taken to minimise dust such as the use of blast nets, canvas covers and watering.
- (c) Wire mesh made of heavy-duty tyres or sand bags should be used over blast area on each shot to prevent flying rock and reduce dust.
- (d) Blasting technique should be consistent not only with nature and quantity of rock to be blasted but also the location of blasting.
- (e) The contractor shall give due preference to explosives with better environmental characteristics.
- (f) Vibration shall be monitored during blasting and values shall not exceed as those given in this Environmental Management Manual

9.2 Containment of Water Pollution

- (a) At construction depots and batching plants temporary drainage works should be maintained, removed and reinstated as necessary and all other necessary precautions should be taken for avoidance of damage by flooding and silt.
- (b) Sedimentation tanks or other acceptable measures, of sufficient capacity to trap silt-laden water before discharge into the outlet drain should be provided. The system should be flexible and be able to handle multiple inputs from a variety of sources.

- (c) Temporary open storage of excavated materials from cut and cover-tunneling work used for backfill on site should be covered with tarpaulin or similar fabric during rainy season or at any time of the year when rainstorms are likely. Washout of construction or excavated materials should be diverted to drainage system through appropriate sediment traps.
- (d) Bentonite slurries or other grouts used in diaphragm wall construction piling and other concrete works should be collected in a separate slurry collection system. If reuse is not practicable then it should be disposed off at nearest landfill site after obtaining permission from agency owning the landfill and under the conditions imposed by the agency concerned, or to a different disposal location as advised by the Employer.
- (e) The Contractor shall discharge wastewater arising from site offices, canteens or toilet facilities constructed by him into sewers after obtaining prior approval of agency controlling the system. A wastewater drainage system shall be provided by the Contractor to drain wastewater into the sewerage system.
- (f) Oil separator/interceptors shall be provided at Batching Plant and construction depot location for vehicle maintenance to prevent the release of oils and grease into the drainage system. These shall be cleaned on a regular basis.
- (g) A Spill Prevention and Control Procedure shall be prepared to identify project components such as storage areas, storage tanks that could allow discharge of oil grease or hazardous materials to the drainage system or ultimately in any water body during spillage. The volume of spill should be calculated as well as storage volume to contain spill within the materials storage containment areas. The procedure shall include measures to contain and mitigate transportation of oil, grease or hazardous materials to the drainage system or any water body.
- (h) Surface run-off from construction depots and batching plants should be discharged into storm drains via adequately designed sand/silt removal facilities such as sand traps silt traps or sediment basins.
- (i) Perimeter channels/drains should be constructed in advance of site formation works and earthworks. Silt removal facilities, channels and manholes should be maintained and the deposited silt and grit should be removed regularly, to ensure that these facilities are functioning properly at all times.
- (j) Construction works should be programmed to minimize soil excavation works in rainy seasons (July to September). If excavation in soil could not be avoided in these months or at any time of year when rain are likely, for the purpose of preventing soil erosion, temporarily exposed slope surfaces should be covered e.g. by tarpaulin, and temporary access roads should be protected by crushed stone or gravel, as excavation proceeds. Arrangement should always be in place to ensure that adequate surface protection measures can be safely carried out well before the arrival of rains.
- (k) Measures should be taken to minimize the ingress of rainwater into trenches. If excavation of trenches in wet seasons is necessary, they should be dug and backfilled in short sections. Rainwater pumped out from trenches or foundation excavation should be discharged into storm drains via silt removal facilities.
- (l) Open stockpiles of construction materials (e.g. aggregates, sand and fill material) on sites should be covered with tarpaulin or similar fabric during rainstorms. Measures should be taken to prevent the washing away of construction materials, soil, silt or debris into any drainage system.

- (m) Manholes (including newly constructed ones) should always be adequately covered and temporarily sealed so as to prevent silt, construction materials or debris from getting into the drainage system, and to prevent storm run-off from getting into sewers. Discharge of surface run-off into sewers must always be prevented in order not to unduly overload the sewerage system.
- (n) Groundwater pumped out of wells, etc. for the lowering of ground water level in basement of foundation construction, and groundwater seepage pumped out of tunnels under construction should be discharged into storm drains after the removal of silt in silt removal facilities.
- (o) Wastewater from Concrete Batching & Precast Concrete Casting and that generated from the washing down of mixer trucks and drum mixers and similar equipment should wherever practicable be recycled. The discharge of waste water should be kept to a minimum.
- (p) The section of construction road between the wheel washing bay and the public road should be paved to reduce vehicle tracking of soil and to prevent site run-off from entering public road drains.
- (q) Surface run-off should be segregated from the concrete batching plant and casting yard area as much as possible and diverted to the storm water drainage system. Surface run-off contaminated by materials in a concrete batching plant or casting yard should be adequately treated before disposal into storm water drains.

9.3 Containment of Noise

- (a) Construction of facilities and structures would require the use of equipment, which may generate high noise levels and adversely affect noise sensitive receivers.
- (b) In assessing the impact of construction noise and hence its containment, the nature and level of activities that generate noise, the pathway through which noise travels, the sensitivity of the receptor, and the period of exposure should all be considered.
- (c) Environmental noise is measured in decibels (dB). To better approximate the range of sensitivity of the human ear to sounds of different frequencies, the A-weighted decibel scale (dBA) was devised. As the human ear is less sensitive to low frequency sounds, the A-scale de-emphasizes these frequencies by incorporating frequency weighting of the sound signal. When the A-scale is used, the decibel levels are represented by dBA.
- (d) On this scale, the range of human hearing extends from about 3 dBA to about 140 dBA. A 10-dBA increase is judged by most people as a doubling of the sound level.
- (e) To the extent required to meet the noise limits the Contractor shall use reasonable efforts to include noise reduction measures listed below to minimize construction noise emission levels. Noise reduction measures – include, but not limited to the following:
 - (i) Minimize the use of impact devices, such as jackhammers, and pavement breakers. Where possible, use concrete crushers or pavement saws for tasks such as concrete deck removal and retaining wall demolition.
 - (ii) Equip noise producing equipment such as jackhammers and pavement breakers with acoustically attenuating shields or shrouds recommended by the manufacturers thereof, to meet relevant noise limitations.
 - (iii) Pneumatic impact tools and equipment used at the construction site shall have intake and exhaust mufflers recommended by the manufacturers thereof, to meet relevant noise limitations.

- (iv) Provide mufflers or shield paneling for other equipment, including internal combustion engines, recommended by manufacturers thereof.
- (v) Employ prefabricated structures instead of assembling on-site.
- (vi) Use construction equipment manufactured or modified to dampen noise and vibration emissions, such as:
 - Use electric instead of diesel-powered equipment.
 - Use hydraulic tools instead of pneumatic impact tools.
- (f) Maximize physical separation, as far as practicable, between noise generators and noise receptors. Separation includes following measures:
 - Provide enclosures for stationary items of equipment and barriers around particularly noisy areas on site.
 - Locating stationary equipment so as to minimize noise and vibration impact on community.
- (g) To the extent feasible, configure the construction site in a manner that keeps noisier equipment and activities as far as possible from noise sensitive locations and nearby buildings. Plant and equipment known to emit noise strongly in one direction should where possible, be oriented in a direction away from noise sensitive receptor and reduce the number of plant and equipment operating in critical areas close to noise sensitive receptors.
- (h) Scheduling truck loading, unloading, and hauling operations so as to minimize noise impact near noise sensitive locations and surrounding communities.
- (i) Minimize noise intrusive impacts during most noise sensitive hours.
 - Plan noisier operations during times of highest ambient noise levels.
 - Keep noise levels relatively uniform; avoid excessive and impulse noises.
- (j) Equipment and plant are not to be kept idling when not in use.
- (k) Use only well maintained plant at site, which should be serviced regularly.
- (l) Maintain equipment such that parts of vehicles and loads are secure against vibrations and rattling.
- (m) Grading of surfaced irregularities on construction sites to prevent the generation of impact noise and ground vibrations by passing vehicles.
- (n) Schedule work to avoid simultaneous activities that both generate high noise levels.
- (o) The construction of temporary physical noise barriers.
- (p) If back-up alarms are used on construction equipment, their noise emission level near noise sensitive receptors such as residences, schools, hospitals and similar areas where quiet is essential, should be regulated, especially at night time.
- (q) Select truck routes for muck disposal so that noise from heavy-duty trucks will have minimal impact on sensitive land uses (e.g., residential) and submit to the Employer for approval:
 - Conduct truck loading, unloading and hauling operations in a manner such that noise and vibration are kept to a minimum.

- Route construction equipment and vehicles carrying soil, concrete or other materials over streets and routes that will cause least disturbance to residents in vicinity of work.
 - Avoid operating truck on streets that pass by schools during school hours.
- (r) The maximum permissible sound pressure level for new generator sets (upto 1000 KVA) run on diesel, shall be 75 dB(A) at one metre from the enclosure surface.
- (s) For existing diesel generator sets, the noise from the DG set shall be controlled by providing an acoustic enclosure or acoustic treatment of the room for DG sets. Such acoustic enclosures/acoustically treated rooms, shall be so designed for minimum 25 dB(A) insertion loss or for meeting the ambient noise standards, whichever is on higher side.

9.4 Containment of Waste

- (a) Careful design, planning and good site management can minimise waste of materials such as concrete, mortars and cement grouts. The contractor shall ensure regular maintenance and cleaning of the waste storage areas.
- (b) Construction activities are expected to generate a variety of waste such as:
- (i) General refuse
 - (ii) Construction Waste including waste from excavated material
 - (iii) Chemical waste and
 - (iv) Hazardous waste
- (c) Handling and disposal of such waste may cause environmental degradation and nuisance. To prevent it, such waste has to be handled and disposed properly. As such, transportation and disposal of all waste shall be strictly managed.
- (d) General Refuse
- (i) Each worksite would generate general refuse including paper and food waste. There is likely to be a concentration of such waste at batching plants on major worksite. The storage of general refuse has the potential to give rise to negative environmental impacts.
 - (ii) Handling and disposal of general refuse should cope with the peak construction workforce during the construction period. Provided the refuse is stored and transported in accordance with good practice and disposed at licensed landfills, the negative environmental impacts would be minimal.
 - (iii) General refuse should be stored in enclosed bins or units separate from construction and chemical wastes. An authorised waste collector should be employed by the contractor to remove general refuse from the site, on a daily basis to minimise odour, pest and litter impacts.
 - (iv) Office waste can be reduced through recycling of paper if volumes are large enough to warrant collection.
- (e) Construction Waste
- (i) Construction Waste would mainly arise from the project construction activities and from the demolition of existing structures where necessitated. It includes unwanted materials generated during construction, rejected structures and materials, materials that have been over-ordered and materials, which have been used and discarded such as:
 - Material and equipment wrapping packaging material

- Unusable/surplus concrete/grouting mixes
 - Damaged/contaminated/surplus construction materials; and
 - Wood from formwork and false work.
- (ii) Also, demolition of buildings and houses to accommodate station buildings and construction depots will generate concrete rubble, plastics, metal, glass, asphalt from surfaces, wood and refuse.
- (iii) Waste from excavation would comprise soil, rubble, sand, rock, brick etc.
- (iv) It is estimated that construction activities used generate 2.5mm³ of soil, majority of which will be used for filling purpose.
- (f) Chemical Waste
- (i) Chemical waste is likely to be generated by construction activities. For those processes, which generate chemical waste, it may be possible to find alternatives, which generate reduced quantities or even no chemical waste, or less dangerous types of chemical waste.
- (ii) The contractor should explore the possibilities given in (I) above and produce evidence of the same to the Employer.
- (iii) Containers used for the storage of chemical waste should:
- Be suitable for the substances they are holding, resistant to corrosion, maintained in good condition, and securely closed.
 - Be of adequate capacity and
 - Display a label in English and Hindi as to the contents, quantity and safe method of disposal in accordance with instructions contained in MSDS.
- (iv) The storage area for chemical waste should:
- Be clearly labeled and used solely for the storage of chemical waste;
 - Be enclosed on at least three sides;
 - Have an impermeable floor and bunding, of capacity to accommodate 110% of the volume of the largest container or 20% by volume of the chemical waste stored in that area, whichever is the greatest;
 - Have adequate ventilation;
 - Be covered to prevent rainfall entering and
 - Be arranged so that incompatible materials are adequately separated.
- (iv) Disposal of chemical waste should be via a licensed waste collector; duly authorized by MOEF or West Bengal State Pollution Control Board as the case may be. License of the waste collector shall be shown to the employer on demand.
- (v) The contractor should maintain an inventory of chemicals, solvents and adhesives. He should minimise disposal of excess material, reuse when applicable and dispose of chemical waste properly. He should prepare a plan that identifies proper ventilation, protected clothing and personal protective equipment.
- (vi) The Contractor should have a point of contract that will maintain the above information and conduct periodic inspections.
- (vii) The Contractor should have application matter in place that will ensure high transfer efficiency that reduces over spray or excess application.
- (g) Hazardous Waste

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- (i) Classification of waste as Hazardous shall be in accordance with Hazards Waste (Management & Handling) Rules 1989, and 2003 or its latest amendment.
- (ii) The contractor shall identify all the hazardous waste generated as a result of his activities. If such waste is generated then the contractor shall apply to State Pollution Control Board for 'authorisation' according to Form 1 of the Hazardous rules and dispose the same only to currently authorised recyclers(a list of which can be obtained from state pollution control board) under intimation to the Employer.
- (iii) The Rules given in (I) above shall govern the Classification, Handling, Storage and disposal of such Hazardous Waste.
- (iv) Hazardous waste would mainly arise from the maintenance of equipment. These may include, but not be limited to, the following:
- Used engine oils, hydraulic fluids and waste fuel;
 - Spent mineral oils/cleaning fluids from mechanical machinery;
 - Scrap batteries or spent acid/alkali; and
 - Spent solvents/solutions, some of which may be derived, from equipment cleaning activities.
- (iv) For disposal of waste requiring special attention and hazardous waste the contractor shall enter into agreement with authorised agencies dealing with the same.
- (v) The environmentally hazardous waste shall be stored on an impermeable surface with containment bunding to retain leaks, spills and ruptures.
- (vi) Waste oil and chemical containers shall be delivered to the Contractor's Storage yard. The Contractor is responsible for the correct storage and handling of waste oil/waste chemical containers unit such a time that they are transported to the chosen disposal area or waste oil containers.
- (vii) All waste collection containers shall be of appropriate size with a closed lid. Each container will be clearly labeled both with a color code system and labeled in Hindi and English. Original labels of empty containers should be completely covered over and the contents of the type of waste stored in the used containers clearly indicated.
- (g) Storage and Segregation of Waste
- (i) Disposal and collection points should be established around all construction work sites. The waste containers should be at least 50L/100L
- (ii) The burning of refuse at construction sites is not permitted.
- (iii) The contractor shall enter into a contract with Municipal Corporation of Kolkata to collect waste from Construction depots, Labour Colony etc. and dispose it at their landfill as per existing norms.
- (iv) The contractor is responsible for the separation of construction and demolition material into re-usable and non-reusable materials, and transfer of these materials to low laying areas or landfills, depending on the type of material and the percentage of inert material.
- (v) Segregation of Waste should be done on site. All construction waste including debris should be sorted on site into inert and non-inert components as given in Table - I. Different areas of the worksites should be designated for such segregation and storage wherever site conditions permit.

Table –1

Storage of Waste

| Waste Container | Colour Code | Sign |
|--------------------------|-------------|-----------------|
| Landfill / Biodegradable | Green | Waste |
| Recyclable | Blue | Paper & Plastic |
| Burning / Combustible | Red | Burning |
| Scrap Metal | Brown | Metal |

- (vii) On-site measures promoting proper segregation and disposal of construction waste should be implemented e.g. provide separate containers for inert (rubber, sand, stone etc.) and non-inert (wood, organics etc.) wastes. The inert waste should be used on site before disposed of at filling area and the non-inert waste should be sorted for re-use or recycling before being transported to landfills.
- (viii) Non-inert materials such as wood, glass and plastic are acceptable for disposal to a landfill as a last resort if these can no longer be reused or recycled.
- (ix) Inert materials such as excavated materials comprising soil, rubble, sand, rock, brick and concrete should be separated and broken down to size suitable for subsequent filling in low lying areas, if it is determined that such material can no longer be reused at the site itself.
- (h) Reuse and Recycle
 - (i) Some good quality reusable topsoil is expected from site clearance works across agricultural land over the banks of Yamuna River. This can be locally stockpiled and used later in final landscaping works, thus saving on costs for such works and transportation and environmental impacts of disposal.
 - (ii) The design of formwork should maximise use of wooden panels so that high reuse levels can be achieved. Alternatives such as steel formwork should be considered to increase the potential for reuse.
 - (iii) The contractor should recycle as much of the construction waste as possible on-site. Proper segregation of waste types on site will increase the feasibility of certain components of the waste stream by recycling contractors.
 - (iv) Excavated materials are usually inert such as soil and rock, and can normally be reused on site or in public filling areas. The excavated material may have to be temporarily stockpiled on-site for subsequent re-use.
 - (v) Steel and other metals should be recovered from the construction waste and recycled as far as practical. If possible, scrap steel mills can use steel bars.
- (k) Transportation of Waste
 - (i) The transportation of construction spoil shall be allowed only to officially designated dumpsites after obtaining necessary permission from appropriate authority.
 - (ii) A procedure to facilitate tracking of loads should be developed to prevent illegal disposal of waste. This procedure should include, inter alia, the name of driver, vehicle registration number, type and quantity of waste, place and time of origin, place of disposal and route of haulage.
 - (iii) In orders to avoid dust or odour impacts, vehicles leaving a site carrying excavate should have their load covered. Vehicles should be routed as far as possible to avoid sensitive receivers in the area.

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- (iv) Contractors who produce significant quantities of scrap are obliged to enter into agreement with authorised dealers of scrap for its disposal. Copies of such agreements shall be shown to the Employer on request.
 - (l) Training
 - (i) The Contractor's Environmental Department is responsible for training of workers and personnel involved in generation of waste.
 - (ii) The contractor shall provide training for workers about the concepts of site cleanliness and appropriate waste management procedure, including waste separation, reduction, reuse and recycling. Failure to do so would result in poorly separated waste, resulting in difficulties in treating the waste correctly and/or a bad market for reuse /recycling.
 - (iii) The awareness will be created through briefings and toolbox talks. The personnel/workers should be trained in waste classification and separation. The training should include:
 - Organic waste
 - Combustible waste
 - Hazardous waste
 - Minimisation of waste
 - (iv) Separation awareness training shall be given to employees responsible for the separation of the waste and information regarding waste separation shall be posted at appropriate locations around the site.

10.0 HOUSEKEEPING

- 10.1 The Contractor shall constitute a special group of house keeping personnel in charge of each work section. Senior engineer of each section shall be responsible for house keeping at their respective sites.
- 10.2 Each section of work site shall maintain the site reasonably clean, keep free from obstruction and properly store any construction equipment, tools, and materials. Any wreckage, rubbish shall be temporarily stored in wreckage and rubbish bins. These wreckage and rubbish bins shall be cleaned at frequent intervals. Special house keeping group will ensure daily cleaning work at the site and its surrounding areas.
- 10.3 General House keeping shall be carried out and ensured at all times at work sites, Labour Camps, Stores and Offices.
- 10.4 Full height fence, barriers etc. will be installed at the site in order to preserve the surrounding area from excavated soil, rubbish etc which may cause inconvenience to public.
- 10.5 The Contractor will ensure that all sub-contractors maintain the site reasonably clean through the sub-contract's provision related to house keeping.
- 10.6 The Contractor's designated department will, through daily pre-work meeting (tool box talk), safety meeting etc. will impart the necessary introduction and education to labor on house keeping. This will be done through toolbox talks. Other staff such as supervisors and engineers working at the site will also be educated on the necessity of good house keeping.
- 10.7 Every individual would be responsible for house keeping in his area i.e.
 - At Work Site: All workers should clean their work place after completion of their job. Supervisor should ensure good house keeping of their respective work area through their workers. Section Managers shall ensure house keeping in their area through their supervisors. Contractor's designate department will monitor this activity through section manager as well as site supervisor.

- At Labour Camp: All workers should be responsible to maintain good house keeping and hygienic condition in their respective rooms/dormitories. The Contractor should ensure the availability of dustbins at required place and regular cleaning of rooms, kitchens, toilet blocks and dustbins. Safe disposal of all waste materials, should also be ensured. Arrangement for regular fumigation should be made by the contractor.
- At Store: Proper access and stacking shall be ensured at the Stores. A list will display daily stock of materials. All work material should be stored in clearly marked containers or at designated storage area.
- At Office: Every one is responsible to maintain house keeping of their work station. Disposal of waste materials (i.e. stationary, cigarette butts, tea bags etc.) must be in dustbin only.

10.8 Avoidance of Nuisance

- (a) The Contractor shall take all precautions to avoid any nuisance arising from his operations. This shall be accomplished, wherever possible by suppression of nuisance at source rather than abatement of the nuisance once generated.
- (b) Following site clearing and before construction, the Contractor shall remove all trash, debris and other weeds.
- (c) The Contractor shall ensure that the work place is free of trash, garbage, debris and weeds.
- (d) The Contractor shall provide at site, metal or heavy-duty plastic 'Refuse Containers' with tight fitting lids for disposal of all garbage or trash associated with food. The containers shall not have openings that allow access by rodents.
- (e) To keep the area free of litter and garbage, specific locations shall be designated for consuming food and snacks to prevent random disposal of waste. All waste shall be deposited in the refuse containers. Suitable all weather signage shall be prominently displayed for compliance of these requirements.
- (f) The refuse containers shall be kept upright with their lids shut. These containers shall be emptied at least once daily by the Contractor to maintain site sanitation. There shall be different containers for bio-degradable/recyclable and hazardous (flammable) wastes.
- (g) All plants/equipment/machinery shall be well maintained by regular servicing and kept free from oil/grease dripping. Drip pans of suitable size shall be used to collect oil leakages and spills. The area shall be cleaned after completion of maintenance/repair and generated waste disposed off in approved manner.
- (h) The contractor shall make available Material Supply Data Sheet (MSDS) for material/chemicals/substances used, for which these are available to the Employer when requested.
- (i) Such material/chemicals/substances used shall be treated, handled, stored, transported and disposed off, by the contractor, in a manner specified in the MSDS.

10.9 Prevention of Mosquito Breeding

- (a) Measures shall be taken to prevent mosquito breeding at site. The measures to be taken shall include, but not limited to, the following:
 - (i) Construction run off shall not be allowed to stagnate at work sites specially at construction depots and batching plant locations, by executing an efficient drainage system and/ or leveling off low lying areas;
 - (ii) Empty cans, oil drums, packing and other receptacles which may retain water shall be deposited at a central collection point and shall be removed from the Site regularly;

- (iii) Still waters shall be treated at least once every week with oil in order to prevent mosquito breeding;
- (iv) Contractor's Equipment and other items on the Site, which may retain water, shall be stored, covered or treated in such a manner that water could not be retained.
- (b) Posters in both Hindi and English which draw attention to the dangers of permitting mosquito breeding shall be displayed prominently on the site.

11.0 LANDSCAPE AND AESTHETICS

- 11.1 The Contractor should be able to demonstrate evidence that the landscape and aesthetics quality during construction have been considered and appropriate actions have been taken to mitigate negative impacts due to construction.
- 11.2 The construction of metro system will have negative but temporary impacts on the landscape and aesthetics due to loss of amenities and trees. Large-scale construction activity will impact negatively on roadside areas and residential communities immediately adjacent to the construction sites.
- 11.3 However, transplanting, replanting of trees and additional landscape treatment is likely to result in long-term beneficial impacts. Some such species are given in Table –2 for guidance.

Table – 2
Recommended species for Plantation and Landscaping

| S.No. | Botanical Name | Common Name |
|-------|---------------------------|------------------------|
| A. | TREES | |
| 1. | Bambusa goldiana | Golden Bamboo |
| 2. | Bauhinia blackiana | Kachnar |
| 3. | Cassia renigera | Pink Cassia |
| 4. | Ficus regionald (Topiart) | RegionalD |
| 5. | Ficus retusa | Retusa |
| B. | PALMS | |
| 1. | Areca leutescens | Areca Palm |
| 2. | Cycus Revoluta | Cycus |
| 3. | Oreodoxa Regia | Royal Palm/Bottle Palm |
| 4. | Phoenix palm | Date Palm |
| 5. | Rhaphis palm | Rhaphis Palm |
| C. | GROUND COVER | |
| 1. | Asparagu sprengeril | Asparagus |
| 2. | Chlorophytum comosum | Chlorophytum |
| 3. | Duranta goldeana | Golden Duranta |
| 4. | Iresin herbestii | Lal Sag |
| 5. | Lantana alba | White Lanta |

- 11.4 Light used for construction lighting can illuminate adjacent areas in undesired ways. Such lighting and glare shall be prevented from striking adjacent areas, where feasible, through directional shielding.
- 11.5 The other measures include but not limited to:
 - (a) Erection of decorative screen hoarding prominently displaying the logo of Kolkata Metro Rail Corporation.
 - (b) Minimising height of temporary buildings.
 - (c) Careful positioning of construction equipment.
 - (d) Eliminating the possibility of stockpiles of material from being visible to public.
 - (e) Strategically placing hi visibility site markings at construction sites indicating facilities, offices and stores.
 - (f) Adequate and properly managed parking of vehicles at construction depots and batching plants.
- 11.6 Consent for height of stacks of Diesel Engines with rating more than 800 KV shall be obtained by the Contractor from statutory Government agency. Where the calculated height

of stack is obtrusive and does not blend with the neighborhood, the contractor will provide either alternative sucrose of power or provide a solution that is acceptable to the employer. This may include but not limited to providing appropriate cladding for the stack.

12.0 ENERGY MANAGEMENT

- 12.1 By using energy efficiently, the same services can be delivered with less energy, which helps protect the environment by preventing pollution.
- 12.2 Most of the energy including electrical, required during construction, would be generated by burning fossil fuels. When we use less energy, fewer fossil fuels are consumed which means less pollution. Thirty percent of energy consumed in buildings is used unnecessarily or inefficiently according to ENERGY STAR.
- 12.3 The contractor should optimize the use of tools and plants and equipment to perform tasks with correct power. Optimizing cable sizes and joints can control voltage drops.
- 12.4 The contractor should use energy efficient pumps (at least 80% efficiency) and motors (95% efficiency or more). The efficiency should be measured during installation and also periodically.
- 12.5 The contractor should use Diesel Generating sets that have specific fuel consumption of at least 3.5 units per litre of diesel. The contractor should rigorously follow the maintenance regime of his DG sets.
- 12.6 The contractor should maximize the use of energy efficient luminaries such as CFLs and T5 florescent tubes, metal halide lamps and similar and ensure optimum illumination levels to save energy. The contractor shall make provision of Earth Leakage Circuit Breakers (ELCBS) to prevent loss of excessive earth currents which are unsafe.
- 12.7 The contractor should plan in advance and select locations to receive and store material such that these are at the least distance from place of use. Such an approach will result in less energy being consumed since optimum energy will be expended for transport of material.
- 12.8 The contractor should plan works in a manner as to avoid reworking especially during meeting the interface requirements of systems contractor.

13.0 TRAFFIC MANAGEMENT

- 13.1 Traffic Management for the project includes public roadways and sidewalks and the maintenance of access to residence, business and public services throughout the construction area. Traffic delays and reduction in roadways capacity are anticipated during aspects of the construction of the metro rail.
- 13.2 Even though vehicular, pedestrian and surface transit traffic will be impacted at a few locations, the contractor should minimize such impacts through the development of Traffic Management Plans, which will be submitted in advance to the Employer for his approval. These plans will provide specific guidance on traffic management for various portions of construction zones and staging.
- 13.3 The types of mitigation measures to be implemented by the contractors will be on a site-specific basis and will include
 - Signage and barriers for protecting and guiding pedestrians
 - Detour signs placed at strategic locations

- Relocation of bus stops at construction sites
- Provision of side walks of least 2m where feasible
- Physical separation between construction zone and side walks of concrete barriers or wood fencing or mesh fencing

13.4 Wherever heavy equipment like cranes or dozers have to be moved on public roads and the normal moving dimensions are infringed, these shall be moved under advice to traffic police, and with adequate precautions and at low speed.

14.0 ARCHAEOLOGICAL AND HISTORIC RESOURCES

14.1 During the construction period, archaeological or historic resources may potentially be affected by direct or indirect construction activity.

14.2 Prior to the initiation of construction KMRC intends to review without objection a resource protection plan for historic structures where it appears they may be affected by the project. This plan will be developed by the civil contractor in consultation with The Archaeological Survey of India (ASI).

14.3 The plan will identify the sensitive resources as well as specify the construction monitoring requirements. These requirements may include ground vibration monitoring and recording any components inadvertently subjected to impact.

14.4 In the event the project will affect a previously unidentified historic property, work in the area of discovery shall cease until actions that will take into account the effect of the undertaking on the property can be implemented. The Ministry of Environment and KMRC shall determine how to proceed.

15.0 ENVIRONMENTAL MONITORING - GENERAL

15.1 The Contractor's Environmental Team shall carry out the monitoring of environmental impacts during construction. Representative sensitive receivers in the vicinity of the works shall be monitored for noise and air quality impacts.

15.2 For carrying out impact monitoring for noise and air, equipment shall be provided, operated and maintained by the Contractor. The equipment shall be kept in a good state of repair in accordance with the manufacturer's recommendations and maintained in proper working order with sufficient spare equipment available in the event of breakdown to maintain the planned monitoring programme.

15.3 The calibration of monitoring instruments and their respective calibrators shall be carried out in accordance with the manufacturer's requirement to ensure they perform to the same level of accuracy as stated in the manufacturer's specifications.

15.4 Suspended Particulate Matter (SPM) levels shall be measured by following the standard high volume sampling method as set out in High Volume Method for Suspended Particulate, BIS: 5182-1981. Respirable Particulate Matter (RPM) shall be measured in underground station and tunnels in accordance with BIS 5182 Part 4, on the direction of Employer.

15.5 24-hour average SPM concentration shall be measured by drawing air through a High Volume Sampler (HVS) fitted with pre-weighted Glass Fiber filter paper at an average flow rate not less than 1.1m³ per minute. Similarly for RPM, respirable dust sampler, fitted with pre-weighted Glass Fiber and average flow rate of not less than 1.1m³/min shall be used. The duration of monitoring of RPM shall be 24 hrs.

- 15.6 The minimum requirements to the specifications of sound level meter are given in IS: 9779-1981.
- 15.7 Employer will undertake baseline monitoring to establish background levels. Action Level of the Contractor shall be based on the results of baseline monitoring programme, which will be made available to him.
- 15.8 The Contractor's monitoring programme is summarised in Table –3.

**Table –3
Summary of contractor's Environmental Monitoring Programme**

| Parameter | Noise | Air | |
|--------------------------------------|--|---|---|
| | Day Time (6 AM – 10PM) L_{max} , L_{eq} , L_{10} , L_{90} Night Time (10PM – 6AM) L_{max} , L_{eq} , L_{10} , L_{90} | SPM 24 hour | RPM 24 hour |
| Sampling | | | |
| Frequency at each location | Once a week (when noise-generating activities are underway. | Two 24 hours samples every fifteen days. | One 24 hours sample every 15 days |
| Locations and number | To be determined, by the Contractor and approved by the employer based on noise sensitive receptors, but at least at all metro station sites, Batching Plant and sensitive sites such as school, hospital archeological sites etc. | To be determined by the Contractor and approved by the employer, based on air sensitive receptors, but at least all metro station sites, Batching Plant and sensitive location like school hospital archeological site etc. | Inside tunnel and station box as directed by Employer |
| Duration of Monitoring by Contractor | During Civil Construction | During Civil Construction | |
| Additional Monitoring | As directed by the Employer | As directed by the employer. | |

16.0 AIR MONITORING

- 16.1 Construction activities that will generate dust impacts include excavation, material handling and stockpiling, vehicular movement, and wind erosion of unpaved work areas.
- 16.2 The impact of fugitive dust on ambient air pollution depends on the quantity generated, as well as the drift potential of the dust particles injected into the atmosphere. Large dust particles will settle out near the source and smaller particles are likely to undergo dispersal over greater distance from the sources and impeded setting. SPM and RPM levels will be monitored to evaluate the dust impact during the construction phase of the Project.
- 16.3 The Air Quality Monitoring and Control Plan (AMCP) in contract-specific Site Environmental Plan prepared by the Contractor shall establish procedures to monitor impact air quality and measures to control air pollution including dust suppression due to construction activities at work sites. This plan shall contain description of activities that will cause degradation in air quality, environmental procedures to manage pollutants, monitoring programme record keeping and reporting.

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- 16.4 The Employer shall monitor Contractor's performance of tasks specified and will inspect necessary records, reports and procedures related to the control of air quality given in AMCP.
- 16.5 Information gathered during the AMCP will be catalogued and maintained by the Contractor and shall be available for review by the Employer.
- 16.6 The exact location of the air monitoring stations located near air sensitive receptors adjoining the construction sites, such as residences, schools, and hospitals and placement of monitoring equipment thereat shall be agreed with the Employer prior to commencement of air monitoring programme.
- 16.7 Impact monitoring during the course of the Works shall be carried out at the monitoring stations for two days (continuous twenty-four hours) every fifteen days and where there is a perceived air quality problem.
- 16.8 The Contractor should construct suitable fence, lockable gate, 220V AC power point and suitable access at each air monitoring station. Monitoring stations should be free from local obstructions or sheltering.
- 16.9 Should impact monitoring record dust levels which are:
- ◆ Indicative of a deteriorating situation such that closer monitoring is reasonably indicated, or
 - ◆ When in the opinion of the Employer additional measurements are required in view of deteriorating air quality;

Then, the Employer's Representative may require the Contractor to increase the frequency of impact monitoring at any one or more of the monitoring stations until the results indicate an improving and acceptable level of air quality.

- 16.10 The Contractor shall keep records of air quality monitoring (including location, date, time). The Contractor shall submit a copy of monitoring results to the Employer. The results should represent a statistical evaluation of data by calculating maximum, minimum, mean, for valuation of trends, and comparison with emission standards.
- 16.11 The National Ambient Air Quality Standards given in Air (Prevention and Control of Pollution) Act, 1981 may be referred by the Contractor for Limit Levels of SPM and RPM in ambient air which may be followed in estimating the pollution level caused by Contractor's activities.
- 16.12 Where the Employer determines that the recorded SPM level is significantly greater than the Limit levels, the Employer may direct the Contractor to take effective remedial measures including, but not limited to, reviewing dust sources and modifying working procedures.
- 16.13 Where the recorded baseline levels exceed the ambient air quality standards, then at such locations the limit level is the recorded base line. Contractor shall take all effective remedial measures to contain the levels to their baseline value as a result of his activities. The action level may be varied by and at the sole discretion of the Employer.
- 16.14 The Contractor should inform the Employer of all steps taken to investigate cause of exceedance and immediate action taken to avoid further exceedance through written reports and proposals for action.

17.0 NOISE MONITORING

- 17.1 The activities which are expected to cause noise during the construction of East West Corridor Project, Kolkata include noise from construction equipment, construction activities such as portal construction, earthwork excavation, concreting, viaduct construction and

- removal of spoil and movement of construction vehicles and delivery vehicles traveling to and from the construction and disposal sites.
- 17.2 The level of impact of these noise sources depends upon the noise characteristics of the equipment and activities involved, the construction schedule, and the distance from noise sensitive receptors.
- 17.3 The Noise Monitoring and Control Plan (NMCP) in contract specific site Environmental Management Plan prepared by the Contractor shall establish procedures to monitor construction noise and determine when to apply measures to control noise pollution due to construction activities at works site.
- 17.4 The NMCP will provide site description, define acceptable noise monitoring equipment, provide siting and operating procedures for noise equipment, indicate reports and record keeping on noise monitoring data.
- 17.5 The NMCP will provide guidance for construction activity. It shall also address noise performance criteria used in the selection of construction equipment. In defining the requirements of the NMCP, available measures for noise control, such as, the use of equipment with special exhaust silencers or enclosures, and the construction of temporary enclosures or noise barriers around specific construction site activity areas shall be considered.
- 17.6 The NMCP will be reviewed on a regular basis and updated as necessary to assure current construction activities are addressed.
- 17.7 The Employer shall monitor Contractor's performance of tasks specified, and will inspect necessary records, report and procedures related to the control of noise.
- 17.8 Noise monitoring shall be carried out at noise sensitive receptor locations within 200 feet of the construction site once each week and after a change in construction activity. Construction noise measurements shall coincide with daytime and nighttime periods of maximum noise generating construction activities.
- 17.9 The appropriate parameter for measuring construction noise impacts shall be the equivalent A-weighted sound pressure level (L_{eq}) measured in decibels (dB). The two statistical sound levels L_{10} and L_{90} ; the level exceeded for 10 and 90 percent of the time respectively, shall also be recorded during monitoring. The L_{90} may be considered as the ambient level into which the L_{10} as average peak level intrudes. The L_{max} , L_{eq} , L_{10} and L_{90} values will be reported in the noise measurement form along with allowable noise limit. The duration of monitoring shall be for a minimum of 30 minutes.
- 17.10 In no case shall the Contractor expose the public to construction noise levels exceeding 90dBA(slow) or to impulsive noise levels with a peak sound pressure level exceeding 140dB as measured on an impulse sound level meter.
- 17.11 Limit for construction noise is based on the existing ambient noise levels in areas adjoining the construction sites. If the measured noise levels exceed the noise limits, the noise levels shall be reduced by appropriate abatement measures.
- 17.12 The noise levels emanating from any source during construction, shall not exceed 10 dB (A) or more above existing ambient pre-construction noise levels when measured at a point outside the premises of the location of source. The same may be varied from time to time by and at the sole discretion of the Employer.

- 17.13 Where there are no ambient noise measurements, the construction activities shall be limited to levels measured at a distance of 200 feet from the construction limits or at the nearest affected building, whichever is closer, as given in **Table - 4**.

Table- 4
Allowable construction noise

| LAND USE | MAXIMUM NOISE LEVELS – L _{max} dB (A) | |
|-------------|--|------------|
| | Day Time | Night Time |
| Residential | 75 | 65 |
| Commercial | At all Times | |
| Industrial | 85 | |
| | 90 | |

- 17.14 The ground borne noise levels within building structures due to tunnel boring machine and any other underground and tunneling construction activities shall not cause interior noise levels to exceed the levels given below as measured in the inside of the affected noise sensitive structure:

Residential: L_{max} 55dB(A)
Commercial: L_{max} 60dB(A)

- 17.14 At the surface of the construction site during nighttime hours, the Contractor shall use only equipment that operating under full load meets the noise limits specified in **Table-5**, if a sensitive receptor would be affected.
- 17.15 The adjustments for close in equipment noise measurement shall be made in accordance with **Table - 6**.
- 17.16 Should the impact monitoring record noise levels which are:
- indicative of a deteriorating situation such that closer monitoring is reasonably indicated, or
 - when in the opinion of the Employer additional measurements are required in view of deteriorating noise environment,

then, the Employer may require the Contractor to increase the frequency of impact monitoring at any one or more of the monitoring stations until the results indicate an improving and acceptable level of noise.

Table - 5
Noise emission limits for construction equipment measured at 50 feet from construction equipment*

| Equipment Category | L _{max} Level dB(A) |
|--------------------|------------------------------|
| Backhoe | 80 |
| Bar Bender | 75 |
| Chain Saw | 81 |
| Compactor | 80 |
| Compressor | 80 |
| Concrete Mixer | 85 |
| Concrete Pump | 82 |
| Crane | 85 |
| Dozer | 85 |
| Front End Loader | 80 |

| | |
|-----------------|----|
| Generator | 82 |
| Gradall | 85 |
| Grader | 85 |
| Paver | 85 |
| Pneumatic Tools | 85 |
| Scraper | 85 |
| Tractor | 84 |

Table – 6
Adjustments for close-in equipment noise measurements
(Measurement Values to be subtracted from Measured Sound)

| <u>Distance (Feet)</u> | <u>Level to Estimate Sound Level at 50 Feet dB (A)</u> |
|------------------------|--|
| 19-21 | 8 |
| 22-23 | 7 |
| 24-26 | 6 |
| 27-29 | 5 |
| 30-33 | 4 |
| 34-37 | 3 |
| 38-42 | 2 |
| 43-47 | 1 |
| 48-50 | 0 |

- 17.17 The Contractor shall inform the Employer of all steps taken to investigate cause of exceedance and immediate action taken to avoid further exceedance through written reports and proposals for action.
- 17.18 The Contractor shall submit a copy of monitoring results. The results should represent a statistical evaluation of data for evaluation of trends and comparison with noise emission standards.
- 17.19 Where the Employer determines that the recorded Noise level is significantly greater than the acceptable levels, the Employer may direct the Contractor to take effective remedial measures including, but not limited to, reviewing noise sources and modifying working procedures.
- 17.20 Protection against the effects of occupational noise exposure should be provided when the sound levels exceed those shown in Table No. 6 below when measured on the A-scale of a standard sound level meter at slow response.
- 17.21 When employees are subjected to sound levels exceeding those listed in the Table No. 7 feasible administrative or engineering controls should be utilized.
- 17.22 If such controls fail to reduce sound levels within the levels of the table, personal protective equipment shall be provide and used to reduce sound levels within the levels of the table.

Table - 7
Permissible Noise Exposures

| <u>Duration per day, Hours</u> | <u>Sound level (slow Response)</u> |
|--------------------------------|------------------------------------|
| 8 | 90 |
| 6 | 92 |
| 4 | 95 |
| 3 | 97 |
| 2 | 100 |
| 1 ½ | 102 |
| 1 | 105 |
| ½ | 110 |

| | |
|-----------|-----|
| ¼ or less | 115 |
|-----------|-----|

17.23 When the daily noise exposure is composed of two or more periods of noise exposure of different levels, their combined effect should be considered, rather than the individual effect of each. Exposure to different levels for various periods of time shall be computed according to the formula as given below.

$$F_e = (T_1/L_1) + (T_2/L_2) + \dots + (T_n/L_n) \text{ where:}$$

F_e = The equivalent noise exposure factor.

T = The period of noise exposure at any essentially constant level.

L = The duration of the permissible noise exposure at the constant level (from Table)

If the value of f exceeds unity (1) the exposure exceeds permissible levels.

17.24 A sample computation showing an application of the above formula is as follows. An employee is exposed at these levels of these periods:

11db A 1/4 hour.

100 db A 1/2 hour.

90 db A 1/2 hours.

Then,

$$F_e = (1/4 \cdot 1/2) + (1/2 \cdot 2) + (1 \cdot 1/2 \cdot 8)$$

$$F_e = 0.500 + 0.25 + 0.188$$

$$F_e = 0.938$$

Since the value of F_e does not exceed unity, the exposure is within permissible limits.

17.25 The vibration level limits at work sites adjacent to the alignment shall conform to permit values of peak particle velocity as give in Table No. 8.

Table 8
Permitted Values of PPV

| Sl. No. | Condition of Structure | Max. PPV in mm/sec |
|---------|---------------------------------------|--------------------|
| 1. | Most structures in "good condition" | 25 |
| 2. | Most structures in "fair condition" | 12 |
| 3. | Most structures in "poor condition" | 5 |
| 4. | Water supply structures | 5 |
| 5. | Heritage structures/bridge structures | 5 |

17.26 When Diesel Generator (DG) Sets are used for operation of equipment and machinery, then Ministry of Environment and Forest notification dated 17th May 2002, issued under Environment Protection Act (Protection) Rules, 1986, on noise limits shall apply.

18.0 ENVIRONMENTAL SITE INSPECTION

18.1 Site inspection shall be undertaken by the Contractor's staff to inspect the construction activities in order to ensure that appropriate environmental protection and pollution control measures are properly followed and implemented. The frequency of site inspection shall be at least once a week.

18.2 The Contractor shall prepare an 'Environmental Inspection and Action Reporting System', submit to the Employer for approval and make amendments as suggested. It shall contain a contract specific comprehensive Environment Inspection checklist as requirement of Site Environmental Plan.

18.3 The area of inspection shall not be limited to environmental compliance within the site but areas outside the site which are likely to be affected, directly or indirectly by activities at site.

18.4 Results of inspection shall be discussed with Employer and his recommendations on better environmental protection shall be notified to the Contractor for taking immediate action and rapid resolution of identified non-compliance.

18.5 If significant environmental problems are identified or if there is an environmental complaint or as a part of investigation work, then the Employer shall also carry out Ad hoc site inspection which shall be attended by Contractor's Representative.

19.0 ENVIRONMENTAL AUDITS

19.1 As indicated earlier in this Manual, the Employer may undertake regular audits at quarterly intervals, of the Contractor's onsite practices and procedures as a means of assessing the ongoing performance of the Contractor.

19.2 A checklist of environmental requirements will be prepared and amended as necessary, throughout the construction phase to focus on areas of frequent non-compliance and to reflect the potential impacts associated with specific activities within the construction programme

19.3 The criteria against which the review will be undertaken will be derived from (but not be limited to):

- (a) The approaches, procedures and commitments given by the Contractor in the 'Site Environmental Plan'
- (b) The clauses contained within the Employer's Requirement on Environment.
- (c) The allocation of responsibility for fulfilling environmental requirements and the effective lines of communication with regard to environmental issues;
- (d) Compliance with procedures established to enable and effective response to environmental incident, exceedance or non-compliance;
- (e) The extent and accuracy of record-keeping related to environmental performance indicators;
- (f) The effectiveness of ensuring high levels of awareness with regard to environmental requirements; and
- (g) The effectiveness of environmental management activities, including the speed and effectiveness of responses to complaints.

19.4 The likely protocol will include (but not limited), the auditing of the following activities.

- The allocation of responsibility for fulfilling environmental requirements and effectiveness of lines of communication.
- Compliance with procedures established to enable effective response to environmental issues.
- The extent and accuracy of record keeping related to environment.
- The effectiveness of staff training ensuring high levels of awareness with regard to environmental requirements.
- The speed and effectiveness of responses to complaints.

19.5 The criteria against which the audits will be undertaken shall be derived from the clauses within the Employer's Requirements contract-specific Site Environmental Plan and previous site inspection results.

20.0 REPORTING SYSTEM

20.1 Reporting under the Environmental Management System will contain results of monitoring and inspection programmes.

20.2 In Site Environmental Plan, the Contractor shall prepare and submit monthly Environmental Management Reports in accordance with Employer's Requirements.

20.3 The monthly report shall include (but not limited to) the following:

- Executive Summary
- Brief mention of construction activities
- Monitoring results under AMCP, and NMCP
- Interpretation of monitoring results, significance and influencing factors
- Graphical representation of monitored results over past four reporting periods.
- Details on Fly ash consumption as given in Appendix-III.
- Raw material consumption details such as electricity, diesel, water
- Generation of scrap during the month and sold to authorised recyclers
- Generation of other type of waste and sold to respected authorised buyers.
- Measures to control spills
- Action taken on recommendation under site inspection programme or specific directions.
- Summary of complaints, results of investigations and follow-up action
- Future key issues.

21.0 COMPLAINT RESPONSE PROCESS

21.1 Enquiries, complaints and requests for information can be expected from a wide range of individuals and organisations both private and government. The majority of complaints is likely to be received by KMRC , although the site offices are also likely to be contacted.

21.2 The objective of complaint process is to ensure that public and agency complaints are addressed and resolved consistently and expeditiously.

21.3 The Contractor's Site Manager will be notified immediately on receipt of complaint that may relate to environmental impacts. The Site Manager will immediately inform the Employer.

21.4 Field investigation should determine whether the complaint has merit, and if so action should be taken to address the impact.

21.5 The outcome of the investigation and the action taken shall be documented on a complaint Performa prepared by the Contractor and approved by the Employer in advance of the works.

21.6 Where possible, a formal response to each complaint received shall be prepared by the Contractor within seven days in order to notify the concerned person(s) that action has been taken.

22.0 COMPLETION OF THE EMM PROGRAMME

22.1 The construction of Kolkata East West Project will be undertaken as a series of individual construction contracts with necessarily different construction programme and completion dates.

22.2 The Employer shall maintain an overview of the 'impact causing potential' of each site, monitoring parameter or contract with a view to maintaining the most cost effective use of the environmental resources dedicated to the Project.

22.3 For release of final bill the contractor shall ensure

- (i) Closure of all non-conformance reports

- (ii) Submittal of all environment related documents and records pertaining to monitoring and trend analysis on key parameters such as but not limited to consumption/efficient use of resources such as energy, water material such as cement, fly ash, iron and steel, recycle/reuse of waste etc that shall demonstrate continual improvement in the implementation of Environmental Management System

Appendix –I SITE ENVIRONMENTAL PLAN OUTLINE

| S.No. | SITE ENVIRONMENTAL PLAN OUTLINE |
|--------------|---|
| 1 | GENERAL |
| (i) | The Environmental Policy of the Contractor is clearly defined in the Site Environmental Plan, which, inter-alia, commits the Contractor to follow national and state environmental legislation and regulations. |
| (ii) | The Contractor is committed to KMRC 's Environmental Management System and shall provide desired manpower and financial resources for its success |
| (iii) | The person responsible for day-to-day environmental matters is identified and vested with authority to execute the Site Environmental Plan. The Contractor has environmental lines of communication. |
| (iv) | |
| (v) | Procedure is available for Contractor's system of enforcing good environmental practices of its Sub-contractor. |
| (vi) | The Site Environmental Plan contains procedures for screening material used in the contract, for their environmental friendliness. |
| 2 | ENVIRONMENTAL FRIENDLY CONSTRUCTION PRACTICES |
| | The Site Environmental Plan must contain specific procedures for achieving environmental performance requirements as given in the Employer's requirement on Environment and KMRC Environmental Management Manual. |
| (i) | Procedures for carrying out Aspect/Impact analysis of contractor's proposed works and their affect on environment. |
| (ii) | Procedures for setting up Objectives and Targets commensurate with Employer's requirement on Environment and KMRC Environmental Management Manual and how these shall be met. |
| (iii) | Procedures for formulating Environmental Management Plans and Operational Control Procedures to meet contractual requirements. |
| (iv) | Procedures for offering environmental training and methods for promoting environmental awareness amongst his employees. |
| (v) | The SEP must contain details on Air Monitoring and Control Plan which details Mitigation measures / Corrective Action / Preventive Action and Monitoring Schedule. |
| (vi) | The SEP must contain details on Noise Monitoring and Control Plan which details Mitigation measures / Corrective Action / Preventive Action and Monitoring Schedule. |
| (vii) | The SEP must contain procedures on prevention and control of water pollution from sanitary surface runoff and process wastewater. |
| (viii) | The SEP must contain details on procedures for Storage, handling and disposal of waste including, municipal, construction, chemical and hazardous wastes. |
| (ix) | The SEP must contain procedures for reuse/recycle of waste, selling to authorised recyclers and records thereof. |
| (x) | The SEP must contain procedures for preservation of landscape disturbed due to construction, house keeping and traffic management as required under the contract. |
| (xi) | The SEP must contain procedures for dealing with unforeseen environmental situations under Environmental Emergency. |
| 3 | MONITORING, AUDITS AND RECORDS |
| (i) | The Contractor keeps records of environmental monitoring and the SEP contains provision for reporting results of environmental monitoring in a manner as specified in the contract. |
| (ii) | The Contractor carries out weekly inspection under the 'Environmental Inspection and Action Reporting System' through Environmental Inspection checklist and submits to the Employer. |
| (iii) | The SEP contains procedures for mandatory audits by the contractor as given in the contract. |
| (iv) | The SEP contains provisions for submitting monthly Environmental Quality Management reports. |
| (v) | The SEP contain procedures for recording environmental complaints and response process. |
| | |

Appendix – II Weekly Environmental Inspection Checklist

SUMMARY SHEET

1. Major issues of non-conformity in the past week are:

| Issue | Reason |
|-----------------------------|--------|
| (i) Air (Specify) | |
| (ii) Water (Specify) | |
| (iii) Noise (Specify) | |
| (iv) Waste (Specify) | |
| (v) Storage (Specify) | |
| (vi) Housekeeping (Specify) | |
| (vii) Roads (Specify) | |

2. Over the last week have been able to implement environmental management requirements as per contract

| Yes | No | if not yes reasons are |
|-----|----|------------------------|
| | | (i) |
| | | (ii) |
| | | (iii) |

3. Following issues have not been resolved for more than past two weeks

- (i)
- (ii)
- (iii)

4. Support/Clarification from KMRC required in the following:

- (i)
- (ii)
- (iii)

5. Complaints received in the past week.

| From | Action Taken | Reasons for Delay |
|-----------------------|--------------|-------------------|
| (i) Public | | |
| (ii) Client | | |
| (iv) Statutory Agency | | |

Auditor:

Project Manager

Contract Number:

Contractor:

| | | |
|------------------------------|-------------------------|----------------------|
| Environmental Manager | Project Director | Document No.: |
|------------------------------|-------------------------|----------------------|

Weekly Environmental Inspection

| | | |
|-------------------------|-------------------------|-----------------------|
| Report No.: | Inspection Date: | Inspected by : |
| Inspection Area: | | |
| Participants: | | |

| SL. NO. | ITEM | OBSERVATION | REMARKS | ACTION | |
|------------|--|--|---------|---------|---------|
| | | | | By Date | By whom |
| 1.0 | AIR POLLUTION | | | | |
| 1.1 | Dust (approach roads, adjacent roads, working area, cement handling etc.) | <input type="checkbox"/> Site Satisfactory <input type="checkbox"/> Site Dusty <input type="checkbox"/> Sprinkling carried out as required <input type="checkbox"/> Excavate removal within 2 days <input type="checkbox"/> | | | |
| 1.2 | Generators | <input type="checkbox"/> Satisfactory <input type="checkbox"/> Maintenance regime followed <input type="checkbox"/> Black smoke <input type="checkbox"/> Leaking oil <input type="checkbox"/> Drip Pans not available <input type="checkbox"/> | | | |
| 1.3 | Vehicles | <input type="checkbox"/> Satisfactory <input type="checkbox"/> PUC certificate available <input type="checkbox"/> Black smoke <input type="checkbox"/> Wheel Washed /Cleaned <input type="checkbox"/> Leaking oil <input type="checkbox"/> Side of vehicle clear of mud <input type="checkbox"/> Material transported in closed manner <input type="checkbox"/> | | | |
| 1.4 | Air Monitoring | <input type="checkbox"/> Carried out as per contract <input type="checkbox"/> Results reported as per contract <input type="checkbox"/> Remedial measures in place where required <input type="checkbox"/> | | | |
| 2.0 | WATER POLLUTION | | | | |
| 2.1 | Site Drains | <input type="checkbox"/> Drainage system functional <input type="checkbox"/> No Contamination <input type="checkbox"/> Not blocked by debris/garbage <input type="checkbox"/> No indications of Oil spilled in drains <input type="checkbox"/> Storage of chemical waste not nearby | | | |

| SL. NO. | ITEM | OBSERVATION | REMARKS | ACTION | |
|---------|--|--|---------|---------|---------|
| | | | | By Date | By whom |
| 2.1 | Site Drains | <input type="checkbox"/> storage of refuse/ excavate muck not near the drains | | | |
| 2.2 | Adjacent Drains | <input type="checkbox"/> Not damaged <input type="checkbox"/> No signs of pouring bentonite <input type="checkbox"/> No signs of pouring Chemicals <input type="checkbox"/> Signs of discharging Silt/ debris | | | |
| 2.3 | Separator Tanks | <input type="checkbox"/> Tank not full of silt <input type="checkbox"/> Tank regularly emptied <input type="checkbox"/> | | | |
| 3.0 | NOISE POLLUTION | | | | |
| 3.1 | Noise control measures | <input type="checkbox"/> All powered mechanical equipments are sound reduced <input type="checkbox"/> Acoustic / enclosures constructed in areas of excessive noise <input type="checkbox"/> Equipment located and directed away from noise receptors <input type="checkbox"/> | | | |
| 3.2 | Generators Provided with acoustic enclosures | <input type="checkbox"/> Effective <input type="checkbox"/> Not effective <input type="checkbox"/> Not provided <input type="checkbox"/> | | | |
| 3.3 | Noise Monitoring | <input type="checkbox"/> Carried out as per contract <input type="checkbox"/> Not exceeded baseline values <input type="checkbox"/> Remedial measures in place <input type="checkbox"/> Results evaluated statistically for inclusion in Monthly report <input type="checkbox"/> | | | |
| 4.0 | WASTE MANAGEMENT | | | | |
| 4.1 | Waste Identified | <input type="checkbox"/> Chemical Flammable Corrosive Construction related/ oil/ Filters/ Batteries <input type="checkbox"/> Hazardous <input type="checkbox"/> Other (Specify) <input type="checkbox"/> | | | |
| 4.2 | Storage Containers & Bins | <input type="checkbox"/> Adequate number and properly place <input type="checkbox"/> Proper quality <input type="checkbox"/> Emptied regularly <input type="checkbox"/> Labeling proper <input type="checkbox"/> No spillage on container surface noticed | | | |

| SL. NO. | ITEM | OBSERVATION | REMARKS | ACTION | |
|------------|--------------------------------------|---|---------|---------|---------|
| | | | | By Date | By whom |
| 4.2 | Storage Containers & Bins | <input type="checkbox"/> Pollutants (e.g. waste chemical), not dumped in bins <input type="checkbox"/> Recyclable (e.g. metal) not dumped in garbage bins <input type="checkbox"/> | | | |
| 4.3 | Oil Waste | <input type="checkbox"/> Drip pans available <input type="checkbox"/> No oil stains on ground <input type="checkbox"/> Spill absorption material available <input type="checkbox"/> Waste oil poured in to designated waste drums <input type="checkbox"/> Used oil filters not dumped in garbage bins <input type="checkbox"/> | | | |
| 4.4 | Excavate/Muck | <input type="checkbox"/> Storage satisfactory/ properly secured <input type="checkbox"/> Dumping in authorized areas <input type="checkbox"/> No interference with nearby drainage | | | |
| 5.0 | STORAGE | | | | |
| 5.1 | Diesel Storage | <input type="checkbox"/> Extensive diesel spillage on ground not visible <input type="checkbox"/> Drip pans used when pumping diesel <input type="checkbox"/> Pipes / connectors/ pumps not leaking <input type="checkbox"/> Not located close to storm water drains <input type="checkbox"/> transfer arrangement satisfactory | | | |
| 6. | AESTHETICS & CLEANLINESS | | | | |
| 6.1 | Housekeeping & Hygiene | <input type="checkbox"/> Designated storage area for materials <input type="checkbox"/> Scraps/brickbats/rubbish scattered at site <input type="checkbox"/> Proper space for handling waste <input type="checkbox"/> Area Clean and dry <input type="checkbox"/> Stagnant water treated weekly <input type="checkbox"/> Proper stacking of drums <input type="checkbox"/> Barricades are clean, in line, firmly secured and proper earthing <input type="checkbox"/> Water not allowed to accumulate in work area for any reason <input type="checkbox"/> | | | |

| SL. NO. | ITEM | OBSERVATION | REMARKS | ACTION | |
|------------|---------------------------------|---|---------|---------|---------|
| | | | | By Date | By whom |
| 7.0 | ROADS | | | | |
| 7.1 | Access Roads | <input type="checkbox"/> Satisfactory Maintenance <input type="checkbox"/> In urgent need of Maintenance <input type="checkbox"/> | | | |
| 7.2 | Public Roads used by Contractor | <input type="checkbox"/> Satisfactory maintenance <input type="checkbox"/> Repair not carried out <input type="checkbox"/> | | | |
| | | | | | |

APPENDIX - III - DETAILS ON FLY ASH

The Employer shall give his consent to the civil contractor for using Fly Ash in concrete or brick works. The contractor shall record all relevant details on the consumption of Fly Ash from the data of initial consumption to date of final use.

The details on Fly Ash consumption shall be reported on a monthly basis in the contractor's monthly Environmental Management Report required to be submitted to the Employer.

The details on Fly Ash shall be reported in groups and sub groups as noted below: -

F1 Data required from the Concrete Production Contractor

F1.1 Concrete Production

- Daily records of concrete production
- Mix Design

F1.2 Material consumption from Daily production Records:

- Cement delivery records
- Fly ash delivery records

F1.3 Transportation Cement

- Load capacity of cement delivery vehicles (tons)
- Distance of batching plants to cement plant (km)
- Fuel consumption of delivery vehicles (km/l)

F1.4 Transportation (Fly Ash)

- Load capacity of fly ash delivery vehicles (tons)
- Distance of batching plants to fly ash source (km)
- Fuel consumption of delivery vehicles (km/l)

F2 Data required from Cement Manufacturer (to be obtained by the contractor and submitted to the Employer, on a monthly basis)

F2.1 Process Emission from daily production records

- Quantity of calcareous raw material (limestone etc.) consumed
- % of CaO in raw material
- % of MgO in raw material
- % of CaO in clinker
- % of MgO in clinker
- Quantity of clinker produced

F2.2 Kiln fuel emissions from Monthly Consumption Records

- Quantity of each type of fuel used in the kiln
- CO₂ Emission factor (tons CO₂/MJ) and specific heat for each fuel type (MJ/Kg)
Or % carbon and density (if liquid) for each fuel type

F2.3 Non- Kiln Fuel emission from Monthly consumption records

- Quantity and specific uses for each type of non-kiln fuel used
- CO₂ emissions factor (tons CO₂/MJ) and specific heat for each fuel (MJ/kg)
Or % carbon and density (if liquid) for each fuel type

- F2.4 Emission from Electricity consumption in clinker production from Monthly electricity consumption records
- Electricity consumption of equipment related to cement production (kWh)
 - Grid electricity supplier
 - Quantity of electricity drawn from grid
 - Quantity of electricity self generated
 - Fuel consumption of generating plant
 - Waste heat capture from kiln
- F2.5 Additives from daily production records
- Quantities of all additives blended with clinker at cement plant
- F2.6 Cement Delivery
Monthly records of cement delivery to batching plants